

PSYCHE.

THE PRIMITIVE NUMBER OF MALPIGHIAN VESSELS IN INSECTS.—IV.

BY WILLIAM MORTON WHEELER, PH.D., CHICAGO, ILL.

Ephemeroidea. Schindler* estimates the number of Malpighian vessels of *Ephemeroidea vulgata* at about 40. I have examined the nymphs of three species of Ephemeroidea belonging to the genera *Blasturus* and *Ecdyurus*. In one the vessels open separately into the gut; while in the two others they are distinctly ramified. An older nymph of one of these species had about 12 primary trunks, whereas in two much younger specimens there were only 8. In all three species the vessels were coiled and much enlarged at their tips, so that the whole mass resembled a chevaux-de-frise. Schindler found similar conditions in *Ephemerella flavipes*. I believe that the eight primary trunks in the young Ephemerid represent in great part primitive vessels. The still younger larva or the embryo probably has only 4 or 6 simple diverticula of the hind-gut.

ODONATA. Nothing is known concerning the embryonic Malpighian vessels in this order. Schindler † found

50-60 vessels in imagines of *Libellula flaveola*, *L. depressa*, *Aeschna grandis*, *Calopteryx splendens* and *Agrion puella*. It is more than probable that the larvae and embryos have a much smaller number.

PLECOPTERA. *Perla bicaudata* according to Schindler* has 50-60 vessels. I have been unable to secure embryos of this interesting order. It is certain, however, that the larvae must hatch with very few vessels, since a 5 mm. black and yellow Perlid larva, not uncommon under stones in rapid brooks near Worcester, Mass., had only 14 vessels. The nearly mature nymph of the same species (16 mm. long) had more than 50.

CORRODENTIA. Lespes † found 8 Malpighian vessels in *Termes lucifugus*. Fritz Müller ‡ found 6 or 8 in *Calotermes* and "bei vielen arten von *Termes* und ebenso bei *Eutermes* und

* l. c. p. 623.

† l. c. p. 626.

* l. c. p. 625.

† Recherches sur l'organisation et les moeurs du *Termite lucifuge*. Ann. sci. natur. 4. sér. zool. v. 1856.

‡ Beiträge zur kenntniss der Termiten. Jen. zeitschr. bd. ix, 1875.

Anoplotermes bleibt die zahl der harngefäße zeitlebens auf 4 beschränkt." According to Nitsch* Psocus has 4 urinary tubules and authors ascribe the same number to the Mallophaga, according to Schindler.† Thus, although the number 6 occurs among the Corrodentia, the number 4 appears to be the more typical.

THYSANOPTERA. In his admirable anatomical monograph of this order, Jordan‡ ascertains the number of Malpighian vessels to be 4; 2 extend into the thorax, while the remaining pair lie coiled in the abdomen.

RHYNCHOTA. In Aphides Malpighian vessels were not seen by Schindler.§ Nor do I find any mention of these organs in Will's embryology of the viviparous forms.|| Leydig¶ found a single pair of vessels in the Coccid *Lecanium hesperidum* and Mark** demonstrated

their occurrence in other species of the same group.

All other Rhynchota have 2 pairs, which show some interesting variations, tabulated by Schindler.* In most genera the vessels end blindly, but in others (Nepa, Velia, Gerris, Capsus, Cimex) the ends of the pairs are united in loops. In some genera (Psylla, Cicada, Nepa) the four vessels open separately into the intestine; in others (Pediculus, Cixius, Capsus, Pentatoma), either pair has but a single duct. Frequently the common ducts are swollen into vesicles (Velia, Gerris, Lygacus, Pentatoma, Cimex).

The union of vessels both at their distal and proximal ends is undoubtedly a secondary feature. In the embryos of *Cicada septendecim* and *Zaitha fluminea* I fail to find any union; the vessels arise as four discrete diverticula.

It is more than probable that 4 is the original number of Malpighian vessels in the Rhynchota. The Coccidae and Aphidae, the former with 2, the latter without vessels, have lost one or both pairs. That such is the case is shown by the Coccid *Orthezia cataphracta*,† which still retains 2 pairs.

* Über die eingeweide der bücherlaus, etc. Mag. f. entomol. iv, 1821, p. 277.

† l. c. p. 604.

‡ Anatomie und biologie der Physapoda. Zeitschr. f. wiss. zool. bd. 47. 1888, p. 576 and 578.

§ l. c. p. 639.

|| Entwicklungsgeschichte der viviparen Aphiden. Spengel's Zool. Jahrb. abth. f. anat. u. ontog. bd. iii, 1888.

¶ Zur anatomie von Coccus hesperidum. Zeitschr. f. wiss. zool. bd. v. 1854, p. 3.

** Beiträge zur anatomie u. histologie der pflanzenlaus insb. der Cocciden. Inaug. dissert. 1876 p. 52 et seq.

* l. c. p. 640.

† *Orthezia cataphracta*, eine monographie. Zeitschr. f. wiss. zool. bd. 45, 1887.